Streamlining Our Tarot Matchmaking, Using Probability!

By: Sebastian Saunders

1) Introducing our Tarot system

Most of you reading this will have heard of Tarot cards and decks before. But what actually are they? Tarot as a whole varies quite a lot from person to person, as most astrological-type things do, however the main deck consists of 72 cards total. There are a main 22 – the "major" cards, such as The Fool, Judgement, or The Star, and 50 "minor arcana" cards which are similar to playing cards – with 4 suits (cups, swords, pentacles and wands) with ranks from 1 to king. Each card comes with an attached meaning, which is quite simplistically derived for minor arcana from its numerology and theming based on suit. The major arcana's traits come from their symbolic connotations – for example Justice is about truth and the law. While there is also the possibility of inverted cards, representing darker emotions and spiritual connections, but we will disregard this for the purposes of what we are going to do next.

But how will we use it to matchmake? The main idea we will use for this interpretation is someone's birth tarot. This process, in and of itself, is already mathematical! You take the digits of your birth date, say 11/07/1988, and sum them, in this case we get 35. However, we only stop when we reach a number below 22 – representing the 22 major arcana – so we add digits again to get 8. Each major arcana card has an assigned number up to 22, so we find the corresponding card, Strength. If we stopped at a 2-digit number, we can add again as well to get a second birth tarot, and again if possible for a third.

2) What we want to know – The Birthday Problem

This is the maths we are going to apply here. The Birthday Problem was first proposed by either Harold Davenport or Richard von Mises (published by the latter, accredited to the former). It describes how the chances of finding two people in a room with the same birthday is actually much higher than it first seems, since we are looking for a general match rather than an exact date.

Calculating the number of people it takes to have a 50% of matching birthdays goes as follows:

$$0.5 = 1 - P(not\ matching)$$

$$0.5 = 1 - (\frac{365}{365} \times \frac{364}{365} \times \dots \times \frac{365 - n + 1}{365})$$

$$0.5 = \frac{365}{365} \times \frac{364}{365} \times \dots \times \frac{365 - n + 1}{365}$$

$$0.5 = \frac{365!}{365^n (365 - n)!}$$

From here we would apply exponential approximation that is too complicated to go over in the span of this essay but comes out to:

$$\ln 0.5 \approx -\frac{n(n-1)}{730}$$

$$\ln 2 \approx \frac{n^2 - n}{730} \approx 0.693$$

$$n^2 - n - 505.997 \approx 0$$

Solving this comes out to around n = 23. So, 23 people need to be present for a 50% chance at 2 people sharing the same birthday.

3) Applying this to Tarot

This problem becomes more complicated in our new context as Tarot can have multiple birth cards for certain dates. BUT only on certain birth dates. As such, this depends on the probability that someone has a birthday that comes out to a 2-digit birth card, of which there are 13 (unlucky!).

But how do we wish to matchmake in this way? Do we find “soul pairs” (what we call those who share the same cards) with all cards, or just a single card in common? To make this as interesting as possible, we will consider matching as anyone who shares at least 1 card. Let’s also do our investigation to find the 50% mark for the number of people in our little matchmaking process, as the original birthday problem tackles. If we consider only the past 100 years of dates, we have a total of 36,525 dates total.

Before we do maths with it all, we need to gather a comprehensive list of probabilities for all 22 major arcana, which I did via some python trickery (and manual labour in excel). In doing so, I discovered that the average number of cards per person is 1.45, which makes sense with the ratio of 1st to 2nd cards being around 1:0.45 and everyone having to have at least 1 card.

With those probabilities in hand, we can now get into the interesting part. The equation we will use is as follows:

$$P(no\ shared\ card) = [\prod_{k=1}^{22}(1 - {p_k}^2)]^{\binom{n}{2}}$$

This basically means the chance that a given pair (thus probability of card k squared) does not match on a single card, multiplied through for every card (so they don’t match on any) to the power of however many combinations of the n people there are. While some card “chains” are linked and therefore dependent, it is easier in this instance to just consider every card an individual trait – this is just a standard probability modelling assumption. It may seem strange that we’re first considering the probability of no shared card, but it means that we can then adjust like so:

$$P(shared\ card) = 1 - [\prod_{k=1}^{22}(1 - {p_k}^2)]^{\binom{n}{2}}$$

Since we are aiming for 50%, and I have all the values of p_k in excel, we can now substitute in the value I crunched for the bit in the bracket, ~0.871268:

$$0.5 \approx 1 - [0.871268]^{\binom{n}{2}}$$

$$0.5 \approx [0.871268]^{\binom{n}{2}}$$

$$\ln 0.5 \approx \ln[0.871268]^{\binom{n}{2}}$$

$$\ln 0.5 \approx \binom{n}{2} \times \ln 0.871268$$

$$\ln 0.5 \approx \frac{n!}{2!\,(n-2)!} \times \ln 0.871268$$

$$\ln 0.5 \approx \frac{n(n-1)}{2} \times \ln 0.871268$$

$$\frac{2\ln 0.5}{\ln 0.871268} \approx n(n-1)$$

$$10.06 \approx n(n-1)$$

$$0 \approx n^2 - n - 10.06$$

$$n \approx 3.71 \text{ or } \mathrm{n} \approx -2.71 \text{ (which we can discard)}$$

Therefore, rounding up, we only need 4 people for there to be at least a 50% chance of a pair of lovers, a lot lower than the Birthday Problem's 23! And without showing the workings, I can tell you that to have a 75% chance you would only need about one or two more people, because it comes out to 5.01 people as our n.

4) How can we use this?

This is such an important statistic to know! Looking around online, it seems that the number of people who practice tarot in the UK is around 1.5% of the population, or ~1,040,000 people. If we assume that this cluster sample is still represented accurately by the total UK population, 49.4% of them are already married or in a civil partnership, so let’s say 55% are currently in a relationship, or do not wish to be in one (an extra 6% or so makes sense proportionally). That leaves about 468,000 people who are single and want to be in a relationship, meaning that if we held 93,600 different 5-person birth tarot matchmaking groups, 140,400 people could meet someone in this way. Imagine those groups gathering around a table at their local pub, after the suggestion of friends, just to dramatically reveal their birth tarots from their palms and immediately match!

So, try calculating your birth tarot, and see if it matches anyone around you. Maybe you’ll find your soul pair, and fall in love, under the influence of fate, and probability!